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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/542,208	04/18/2006	Massimo Buscema	084637-011200	1738

32361 7590 07/23/2007
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EXAMINER	
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ART UNIT	PAPER NUMBER
2129	

MAIL DATE	DELIVERY MODE
07/23/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)
	10/542,208	BUSCEMA, MASSIMO
	Examiner	**Art Unit**
	Peter Coughlan	2129

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 May 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-35* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-35* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Detailed Action

1. This office action is in response to an AMENDMENT entered May 2, 2007 for the patent application 10/542208 filed on December 16, 2004.

2. All previous Office Actions are fully incorporated into this Non-Final Office Action by reference.

Status of Claims

3. Claims 1-35 are pending.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 7, 10, 11, 12 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. These claim state the use of 'pre-processing' which is not described within the specification. Paragraph 0117 states 'pre-processing

may be used. Then in paragraph 0117 they may not be used as well. Paragraph 0110 states Fig 3. is an example of preprocessing but there is no algorithm which describes the 'preprocessing' method.

These claims need to be amended or withdrawn from consideration.

Claims 1, 2, 9, 14, 15, 16, 17, 18, 30, 32, 33, 35 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. All these claims state the use of a 'fitness score' without describing within the specification how the 'score' is generated. Since this is a vital element within the invention such a description of its algorithm or method is required.

These claims need to be amended or withdrawn from consideration.

Claims 2, 33 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. These claims use the term 'pseudorandom' which is not described within the specification. As such, the Examiner does not know if

the pseudorandom is located where in the spectrum of non-random or random. The specification lacks an algorithm which describes this function of 'pseudorandom.'

These claims need to be amended or withdrawn from consideration.

Claims 2, 6, 7, 10, 11, 12, 13, 31, 33 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. These claims state the ability to 'optimized' or 'optimization.' There is no stated algorithm, formula, or method which describes the ability to 'optimized' or 'optimization.' There needs to be some description which details how this function is performed.

These claims need to be amended or withdrawn from consideration.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-9, 11-13, 23-25, 30-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Buscema in view of Feldgajer. ('Scientific Background of Dynamic Adaptive Systems, referred to as **Buscema**; U. S. Patent 5832466, referred to as **Feldgajer**)

Claim 1

Buscema teaches defining a set of one or more distributions of the database records onto respective training and testing subsets (**Buscema,** p2, c2:16-34; 'Training subset' of applicant is equivalent to 'training set' of Buscema. 'Testing subset' of applicant is equivalent to 'testing set' of Buscema.); using the defined set of distributions to train and test a first generation set of one or more prediction algorithms and assigning a fitness score to each, each of said prediction algorithms being associated with a certain distribution of said database records. (**Buscema,** p3, C2:11-223; 'Train' of applicant is equivalent to 'training the ANN' of Buscema. 'Test' of applicant is equivalent to 'evaluating' of Buscema.)

Buscema does not teach feeding the set of prediction algorithms to an evolutionary algorithm which generates a set of one or more second generation prediction algorithms and assigns a fitness score to each; continuing to feed each generational set of prediction algorithms to the evolutionary algorithm until a termination event occurs where said termination event is at least one of a prediction algorithm is

generated with a fitness score equal to or exceeding a defined minimum value, the maximum fitness score of successive generational sets of prediction algorithms converging to a given value, and a certain number of generations having been generated selecting a prediction algorithm having a best fitness score.

Feldgajer teaches feeding the set of prediction algorithms to an evolutionary algorithm which generates a set of one or more second generation prediction algorithms and assigns a fitness score to each (**Feldgajer,** abstract, C4:43-64; 'Feeding the set of prediction algorithms to an evolutionary algorithm' of applicant is equivalent to 'using genetic algorithms' which generate 'parameter values preferably define a first broad range of values' of Feldgajer. 'Fitness score' of applicant is illustrates by finding output with the 'best fit' of Feldgajer.); continuing to feed each generational set of prediction algorithms to the evolutionary algorithm until a termination event occurs (**Feldgajer,** abstract, C4:43-64; 'Continuing to feed each generational set of prediction algorithms' of applicant is disclosed by 'new parameters values are assigned to the plurality of groups' of Feldgajer.) where said termination event is at least one of a prediction algorithm is generated with a fitness score equal to or exceeding a defined minimum value(**Feldgajer,** C2:1-26; 'Exceeding a defined minimum' of applicant is disclosed by the neuron and its 'internal potential limit' of Feldgajer. This node can be viewed as the output node of the neural network. The node will fire if the .minimum value' is equaled or exceeded.), the maximum fitness score of successive generational sets of prediction algorithms converging to a given value(**Feldgajer,** C5:63-64; 'Converging to a given value' of applicant is illustrated by the method of employing 'a convergent result.' Of

Feldgajer.) , and a certain number of generations having been generated (**Feldgajer,** C7:50 through C8:17; 'Certain number of generations' of applicant is equivalent to generation counter' of Feldgajer.) selecting a prediction algorithm having a best fitness score. (**Feldgajer**, C4:43-64; 'Fitness score' of applicant is illustrates by finding output with the 'best fit' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by using the iterations of a genetic algorithm to modify the neural networks as taught by Feldgajer to feed the set of prediction algorithms to an evolutionary algorithm which generates a set of one or more second generation prediction algorithms and assigns a fitness score to each; continuing to feed each generational set of prediction algorithms to the evolutionary algorithm until a termination event occurs where said termination event is at least one of a prediction algorithm is generated with a fitness score equal to or exceeding a defined minimum value, the maximum fitness score of successive generational sets of prediction algorithms converging to a given value, and a certain number of generations having been generated selecting a prediction algorithm having a best fitness score.

For the purpose of speeding up the training time, thus reducing the cost.

Buscema teaches using the distribution of database records associated with said selected prediction algorithm in performing supervised learning, said supervised learning including training and testing of prediction algorithms to obtain a trained prediction algorithm. (**Buscema,** p4, Figure 4; 'Using the distribution of database records' of applicant is equivalent to 'Total DB' of Buscema.)

Buscema does not teach wherein said method is performed using a computer and computer software forming an intelligent system.

Feldgajer teaches wherein said method is performed using a computer and computer software forming an intelligent system. (**Feldgajer**, C4:43-64; 'Computer and computer software' of applicant is equivalent to 'computer' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by using a computer as taught by Feldgajer to wherein said method is performed using a computer and computer software forming an intelligent system.

For the purpose of implementing the invention on current hardware for ease of implementation.

Buscema teaches the trained prediction algorithm is effective to predict output variables for data relating to said condition, thereby predicting diagnosis of said condition. (**Buscema,** p2:16-34)

Claim 2

Buscema teaches generating a population of prediction algorithms, where each one of said prediction algorithms is trained and tested according to a different distribution of the records of the data set in the complete database onto a training data set and a testing data set. (**Buscema**, p4 Figure 4; 'population of prediction algorithms ' of applicant is illustrated by ANN1 through ANNn of Buscema.)

Buscema does not teach each different distribution being created as one of a random distribution and a distribution formed by a deterministic mathematical process characterized as a pseudorandom distribution.

Feldgajer teaches each different distribution being created as one of a random distribution and a distribution formed by a deterministic mathematical process characterized as a pseudorandom distribution. (**Feldgajer,** C7:50 through C8:17; 'Random' of applicant is equivalent to 'random' of Feldgajer. 'Pseudorandom' of applicant is equivalent to 'pseudorandom' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by using random and pseudorandom distributions as taught by Feldgajer to each different distribution being created as one of a random distribution and a distribution formed by a deterministic mathematical process characterized as a pseudorandom distribution.

For the purpose of getting a true sample for training purposes

Buscema teaches each prediction algorithm of the said population is trained according to its own distribution of records of the training set and is validated in a blind way according its own distribution on the testing set. (**Buscema**, p4 Figure 4; 'Trained according to its own distribution' and 'validated in a blind way according its own distribution' of applicant is illustrated in the 'training side' and 'validation side' of each ANN of Buscema.)

Buscema does not teach a score reached by each prediction algorithm is calculated in the testing phase representing its fitness an evolutionary algorithm being.

Feldgajer teaches a score reached by each prediction algorithm is calculated in the testing phase representing its fitness (**Feldgajer,** C4:43-64; If Feldgajer can determine which parameter is the 'best fit' then a 'score' must be generated.) an evolutionary algorithm being. (**Feldgajer,** abstract; 'Evolution algorithm' of applicant is equivalent to 'genetic algorithm' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by using a score to rate performance as taught by Feldgajer to have a score reached by each prediction algorithm is calculated in the testing phase representing its fitness an evolutionary algorithm being.

For the purpose of using the score for future selection.

Buscema teaches further provided which combines the different models of distribution of the records of the complete data set in a training and in a testing set which sets are represented each one by a corresponding prediction algorithm trained and tested on the basis of the said training and testing data set according to the fitness score calculated in the previous step for the corresponding prediction algorithm. (**Buscema**, p4 Figure 4; 'Training set' and 'testing set' of applicant is equivalent to 'training' and 'validation' of Buscema.)

Buscema does not teach the fitness score of each prediction algorithm corresponding to one of the different distributions of the complete data set on the training and the testing data sets being the probability of evolution of each prediction algorithm or of each said distribution of the complete data set on the training and testing data sets repeating the evolution of the prediction algorithm generation for a finite

number of generations or till the output of the genetic algorithm converges to a best solution and/or till the fitness value of at least some prediction algorithm related to an associated data records distribution has reached a desired value setting the data records distribution for the best solution as the optimized training and testing subsets for training and testing prediction algorithm.

Feldgajer teaches the fitness score of each prediction algorithm corresponding to one of the different distributions of the complete data set on the training and the testing data sets being the probability of evolution of each prediction algorithm or of each said distribution of the complete data set on the training and testing data sets (**Feldgajer,** C4:43-64; If Feldgajer can determine which parameter is the 'best fit' then a 'score' must be generated.) repeating the evolution of the prediction algorithm generation for a finite number of generations or till the output of the genetic algorithm converges to a best solution and/or till the fitness value of at least some prediction algorithm related to an associated data records distribution has reached a desired value (**Feldgajer,** C7:50 through C8:17; 'Repeating the evolution' of applicant is equivalent to 'performed iteratively' of Feldgajer.) setting the data records distribution for the best solution as the optimized training and testing subsets for training and testing prediction algorithm. (**Feldgajer,** p7:50 through C8:17; 'Setting the data records' of applicant is equivalent to 'altering the population or the parameter values' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by iterating the process between the genetic algorithm and neural networks to modify the neural network as taught by Feldgajer to have fitness

score of each prediction algorithm corresponding to one of the different distributions of the complete data set on the training and the testing data sets being the probability of evolution of each prediction algorithm or of each said distribution of the complete data set on the training and testing data sets repeating the evolution of the prediction algorithm generation for a finite number of generations or till the output of the genetic algorithm converges to a best solution and/or till the fitness value of at least some prediction algorithm related to an associated data records distribution has reached a desired value setting the data records distribution for the best solution as the optimized training and testing subsets for training and testing prediction algorithm.

For the purpose of lowering the cost of training the neural network.

Claim 3.

Buscema teaches that to each record of the data set a distribution variable is associated which is binary and has at least two status, one of this two status being associated with the inclusion of the record in the training set and the other in the testing set. (**Buscema,** p2, c2:16-34; 'Training subset' of applicant is equivalent to 'training set' of Buscema. 'Testing subset' of applicant is equivalent to 'testing set' of Buscema.)

Claim 4

Buscema teaches the prediction algorithm is an artificial neural network. (**Buscema**, p4 Figure 4; 'ANN' of applicant is a 'artificial neural network' of Buscema.)

Claim 5

Buscema teaches the prediction algorithm is a classification algorithm. (**Buscema**, p4 Figure 4; 'ANN' of applicant is a 'classification algorithm' of Buscema.)

Claim 6

Buscema does not teach that once an optimum distribution has been computed, the optimised training data subset is made equal to a complete data set being the individuals included in the training subset distributed onto a new training set and onto a new testing set each one having about the half of the records of the original optimized training set, while the originally optimized testing set is used as a third data subset for validation purposes.

Feldgajer teaches that once an optimum distribution has been computed, the optimised training data subset is made equal to a complete data set being the individuals included in the training subset distributed onto a new training set and onto a new testing set each one having about the half of the records of the original optimized training set, while the originally optimized testing set is used as a third data subset for validation purposes. (**Feldgajer,** C4:43-64; 'Training subset distributed onto a new training set' of applicant is disclosed by the generation of a 'second range of values' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by altering the training set as taught by Feldgajer to have that once an optimum distribution has been computed, the optimised training data subset is made equal to a complete data set

being the individuals included in the training subset distributed onto a new training set and onto a new testing set each one having about the half of the records of the original optimized training set, while the originally optimized testing set is used as a third data subset for validation purposes.

For the purpose of improving the training time.

Claim 7

Buscema does not teach in that the distribution of the data of the originally optimized training set onto the new training and new testing set is optimized by means of a pre-processing phase.

Feldgajer teaches in that the distribution of the data of the originally optimized training set onto the new training and new testing set is optimized by means of a pre-processing phase. (**Feldgajer,** 'Preprocessing phase' of applicant is the 'genetic algorithm' of Feldgajer.) including the steps of said method for optimizing a database of sample records, said records being records in the originally optimized training set (**Feldgajer,** C10:16-26; 'Optimizing a database' of applicant is equivalent to 'method using groups' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by having an algorithm which provides a pre-processing function as taught by Feldgajer to have the distribution of the data of the originally optimized training set onto the new training and new testing set is optimized by means of a pre-processing phase.

For the purpose of resulting in a preprocessed distribution of data.

Claim 8

Buscema teaches in which the different choices of the structure of the training subset and the structure of the testing subset consist in different selections of the number of input variables of the data records of the database, which selections consist in leaving out at least one, preferably two or more variables from the entire input variable set forming each record, the records of the database data base comprising a certain number of known input variables and a certain number of known output variables. (**Buscema**, p4 Figure 4; 'Different choices of structures' of applicant is equivalent to all of the different neural networks, ANN1 through ANNn of Buscema.)

Claim 9

Buscema teaches defining a distribution of data from the complete data set onto a training data set and onto a testing data set (**Buscema,** p2, c2:16-34; 'Training subset' of applicant is equivalent to 'training set' of Buscema. 'Testing subset' of applicant is equivalent to 'testing set' of Buscema.); generating a population of different prediction algorithm each one having a training and/or testing data set in which only some variables have been considered among all the original variables provided in the data sets, each one of the prediction algorithms being generated by means of a different selection of variables (**Buscema**, p4 Figure 4; 'Generating a population of different prediction algorithm' of applicant is equivalent to all of the different neural networks, ANN1 through ANNn of Buscema.) carrying out learning and

testing of each prediction algorithm of the population and evaluating the fitness score of each prediction algorithm. (**Buscema**, p4 Figure 4; 'Learning' of applicant is equivalent to 'training' of Buscema. 'Evaluation' of applicant is equivalent to 'validation' of Buscema.)

Buscema does not teach applying an evolutionary algorithm to the population of prediction algorithms for achieving new generations of prediction algorithm for each generation of new prediction algorithms representing each one a new different selection of input variable, the best prediction algorithm according to the best hypothesis of input variables selection is tested or validated a fitness score is evaluated and the prediction algorithms representing the selections of input variables which have the best testing performances and the minimum input variables are promoted for the processing of the new generations.

Feldgajer teaches applying an evolutionary algorithm to the population of prediction algorithms for achieving new generations of prediction algorithm (**Feldgajer,** C6:1-4; 'Applying an evolution algorithm' of applicant is equivalent to using a genetic algorithm to evolve the learning parameters of the neural network.) for each generation of new prediction algorithms representing each one a new different selection of input variable, the best prediction algorithm according to the best hypothesis of input variables selection is tested or validated (**Feldgajer,** Fig 4; 'New different selection of input variable' of applicant is equivalent to 'modify population of individual neural networks' of Feldgajer.) a fitness score is evaluated and the prediction algorithms representing the selections of input variables which have the best testing

performances and the minimum input variables are promoted for the processing of the new generations. (**Feldgajer,** C4:43-64; 'Fitness score' of applicant is illustrates by finding output with the 'best fit' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by using a genetic algorithm to generate values as taught by Feldgajer to an evolutionary algorithm to the population of prediction algorithms for achieving new generations of prediction algorithm for each generation of new prediction algorithms representing each one a new different selection of input variable, the best prediction algorithm according to the best hypothesis of input variables selection is tested or validated a fitness score is evaluated and the prediction algorithms representing the selections of input variables which have the best testing performances and the minimum input variables are promoted for the processing of the new generations. For the purpose of employing these values to alter a neural network.

Claim 11

Buscema does not teach in which different choices of the structure of the training subset and the structure of the testing subset consist in different selections of the number of input variables of the data records of the database, which selections consist in leaving out at least one, preferably two or more variables from the entire input variable set forming each record, the records of the database comprising a certain number of known input variables and a certain number of known output variables,. and

further comprising a pre-processing phase, including the steps of said method for optimizing a database of sample records, for selecting the most predictive input variables, characterized in that the database subjected to the a pre-processing phase of input variable selection is a training subset and a testing subset processed with said method.

Feldgajer teaches in which different choices of the structure of the training subset and the structure of the testing subset consist in different selections of the number of input variables of the data records of the database, which selections consist in leaving out at least one, preferably two or more variables from the entire input variable set forming each record, the records of the database comprising a certain number of known input variables and a certain number of known output variables (**Feldgajer,** C7:34 through C8:17; 'Minimum number of selected input variables' of applicant is illustrated by a genetic algorithm is used to 'reduce the amount of information required to generate an adequate result' of Feldgajer.), and further comprising a pre-processing phase, including the steps of said method for optimizing a database of sample records, for selecting the most predictive input variables, characterized in that the database subjected to the a pre-processing phase of input variable selection is a training subset and a testing subset processed with said method. (**Feldgajer,** C10:16-26; 'Optimization of the distribution' of applicant is equivalent to 'method using groups' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by reducing the number of variables if possible as taught by

Feldgajer to have different choices of the structure of the training subset and the structure of the testing subset consist in different selections of the number of input variables of the data records of the database, which selections consist in leaving out at least one, preferably two or more variables from the entire input variable set forming each record, the records of the database comprising a certain number of known input variables and a certain number of known output variables, and further comprising a pre-processing phase, including the steps of said method for optimizing a database of sample records, for selecting the most predictive input variables, characterized in that the database subjected to the a pre-processing phase of input variable selection is a training subset and a testing subset processed with said method.

For the purpose of increasing the speed by removing some of the input variables of the neural network.

Claim 12

Buscema does not teach in that the complete database the distribution of the records of which has to be optimized has data records having a selected number of input variables, the selection being carried out with said method, and in which different choices of the structure of the training subset and the structure of the testing subset consist in different selections of the number of input variables of the data records of the database. which selections consist in leaving out at least one, preferably two or more variables from the entire input variable set forming each record, the records of the

database comprising a certain number of known input variables and a certain number of known output variables.

Feldgajer teaches in that the complete database the distribution of the records of which has to be optimized has data records having a selected number of input variables, the selection being carried out with said method, and in which different choices of the structure of the training subset and the structure of the testing subset consist in different selections of the number of input variables of the data records of the database. which selections consist in leaving out at least one, preferably two or more variables from the entire input variable set forming each record, the records of the database comprising a certain number of known input variables and a certain number of known output variables. (**Feldgajer,** C7:34 through C8:17; 'Minimum number of selected input variables' of applicant is illustrated by a genetic algorithm is used to 'reduce the amount of information required to generate an adequate result' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by reducing the number of input parameters as taught by Feldgajer to have that the complete database the distribution of the records of which has to be optimized has data records having a selected number of input variables, the selection being carried out with said method, and in which different choices of the structure of the training subset and the structure of the testing subset consist in different selections of the number of input variables of the data records of the database. which selections consist in leaving out at least one, preferably two or more variables from the entire input variable set forming each record,

the records of the database comprising a certain number of known input variables and a certain number of known output variables.

For the purpose of increasing the speed by removing some of the input variables of the neural network.

Claim 13

Buscema does not teach the pre-processing phases for optimizing the distribution of the records on a training subset and a testing subset and for selecting the most predictive input variables, is carried out alternatively one to the other several times.

Feldgajer teaches the pre-processing phases for optimizing the distribution of the records on a training subset and a testing subset and for selecting the most predictive input variables, is carried out alternatively one to the other several times. (**Feldgajer,** C10:16-26; 'Optimization of the distribution' of applicant is equivalent to 'method using groups' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by optimization the distribution as taught by Feldgajer to have the pre-processing phases for optimizing the distribution of the records on a training subset and a testing subset and for selecting the most predictive input variables, is carried out alternatively one to the other several times.

For the purpose of using existing distribution data as efficiently as possible.

Claim 23

Buscema does not teach characterized in that it is in the form of a software program comprising instructions executable by a CPU, the software program being stored in a memory to which the CPU can access.

Feldgajer teaches characterized in that it is in the form of a software program comprising instructions executable by a CPU, the software program being stored in a memory to which the CPU can access. (**Feldgajer,** C4:43-64; 'Instructions executable by a CPU, the software program being stored in a memory to which the CPU can access' of applicant are all common functions of a 'computer' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by implementing the invention on a computer as taught by Feldgajer to have a software program comprising instructions executable by a CPU, the software program being stored in a memory to which the CPU can access.

For the purpose of implementing the invention on a common device to encourage its use.

Claim 24

Buscema does not teach a software program stored on a memory device, the said software program consisting in the method according to claim 1 in the form of a executable instructions of a CPU or of a computer system.

Feldgajer teaches a software program stored on a memory device, the said software program consisting in the method according to claim 1 in the form of a executable instructions of a CPU or of a computer system. (**Feldgajer,** C4:43-64; 'Software program stored on a memory device, the said software program consisting in the method according to claim 1 in the form of a executable instructions of a CPU or of a computer system' of applicant are all common functions of a 'computer' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by using standard memory with the invention as taught by Feldgajer to have a software program stored on a memory device, the said software program consisting in the method according to claim 1 in the form of a executable instructions of a CPU or of a computer system.

For the purpose of implementing the invention on a common device to encourage its use.

Claim 25

Buscema teaches an apparatus or device for generating an action of response which is autonomously, i.e. by itself. (**Buscema,** p4, Figure 4; The contents of the ANN supervised validation protocol is a stand alone design.) chosen among a certain number of different kinds of actions of response stored in a memory of the apparatus or autonomously generated by the apparatus basing the said choice of the kind of action of response on the interpretation of data collected autonomously by means of one or more sensors responsive to physical entities or which are fed to the apparatus by means of

input means. (**Buscema,** p4, Figure 4, Examples of 'actions and responses' of applicant is equivalent to 'the benign and malignant tumors and their characteristics of Buscema.)

Buscema does not teach the said interpretation being made by means of a prediction algorithm in the form of a software saved in a memory of the said apparatus and being carried out by a central processing unit.

Feldgajer teaches the said interpretation being made by means of a prediction algorithm in the form of a software saved in a memory of the said apparatus and being carried out by a central processing unit. (**Feldgajer,** C4:43-64; 'Central processing unit' of applicant is an element of a 'computer' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by using standard computer operations as taught by Feldgajer to have the said interpretation being made by means of a prediction algorithm in the form of a software saved in a memory of the said apparatus and being carried out by a central processing unit.

For the purpose of implementing the invention on a computer with normal operating characteristics

Buscema teaches characterized in that the apparatus being further provided with means for carrying out a training and testing phase of the prediction algorithm by inputting to the said prediction algorithm data of a known database in which input variables of the input data representing the physical entities able to being sensed by the apparatus through the one or more sensors and/or able to be fed to the apparatus by means of the input means are univoquely correlated to at least one definite kind of

action of response among the different kinds of possible action of response. (**Buscema,** p4, Figure 4; 'Training and testing' of applicant is equivalent to 'testing' and 'validation' of Buscema.)

Buscema does not teach the said means for carrying out the training an testing being in the form of a training and testing software saved in a memory of the apparatus, the said training and testing being carried out by means of a method according to claim 1, the said training and testing software program being the said method of training and testing in the form of a software program or instructions.

Feldgajer teaches the said means for carrying out the training an testing being in the form of a training and testing software saved in a memory of the apparatus, the said training and testing being carried out by means of a method according to claim 1, the said training and testing software program being the said method of training and testing in the form of' a software program or instructions. (**Feldgajer,** C4:43-64; 'Carrying out the training an testing' using 'memory' of applicant are all normal operations of a 'computer' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by using memory to hold testing and training software as taught by Feldgajer to have a means for carrying out the training an testing being in the form of a training and testing software saved in a memory of the apparatus, the said training and testing being carried out by means of a method according to claim 1, the said training and testing software program being the said method of training and testing in the form of' a software program or instructions.

For the purpose of implementing the invention in a normal established method.

Claim 30

Buscema teaches for producing a microarray for genotyping operations (**Buscema,** p4, Figure 4; 'Microarray for genotyping operations' of applicant is equivalent to all the ANN 1 through n of Buscema.), the said method comprising the steps of defining a certain number of theoretically relevant genes or alleles or polymorphisms considered relevant for a certain biologic condition like a tissue structure, a pathology or the potentiality of developing a pathology or an anatomic or morphologic feature. (**Buscema,** p2:16-39; 'Relevant for a certain biologic condition' of applicant is disclosed by classifying new cases for tumors of Buscema.); a) providing a database of experimentally determined data in which each record relates to a known clinical or experimental case of a sample population of cases and which records comprise a certain number of input variables corresponding to the presence/absence of a certain predetermined number of polymorphisms and/or mutations and/or equivalent genes of a certain number of theoretically probable relevant genes, said certain predetermined number of polymorphisms and/or genes forming a set, and one or more related output variables corresponding to the certain biological or pathologic condition of the said clinical and experimental cases of the sample population (**Buscema,** p4, Figure 4; 'Database of experimentally determined data' of applicant is equivalent to 'Total DB' of Buscema.) characterized by the following further steps: determining a selection of a subset of the set of certain predetermined number of polymorphisms and/or genes by

testing the association of the said genes or polymorphisms and the biological or pathological condition by means of mathematical tools applied to the database (**Buscema,** p4, Figure 4; One example of a tool is a artificial neural network' of Buscema.); the said mathematical tools comprise a so called prediction algorithm such as a so called neural network (**Buscema,** p4, Figure 4; One example of a tool is a artificial neural network' of Buscema.); and the further steps are carried out of: dividing the database into a training and a testing dataset for training and testing the prediction algorithm. (**Buscema,** p4, Figure 4; Buscema discloses the database being divided into training and testing sets.)

Buscema does not teach defining two or more different training datasets each one having records with a set of input variables obtained by excluding one or more input variables from the originally defined number of input variables. while for each record the set of input variables of the corresponding training set has at least one input variable which is not a member of the set of input variables of the other training datasets, each said at least one input variable consisting in a different gene or a different polymorphisms and/or a different mutation and/or a different functionally equivalent gene thereof of the originally considered genes or polymorphisms and/or mutations and/or functionally equivalent genes thereof considered theoretically potentially relevant for the biologic or pathologic condition training the prediction algorithm with each of the different training sets defined under point e) for generating a first population of different prediction algorithm which are divided into two groups of mother and father prediction algorithms and testing the said prediction algorithms with the associated testing set

calculating a fitness score or prediction accuracy of each father and mother prediction algorithms of the said first population by means of the testing results; providing a so called evolutionary algorithm such a genetic algorithm and applying the evolutionary algorithm to the first population of mother and father prediction algorithms for achieving new generation of prediction algorithms whose training and testing dataset comprises records whose input variables selections are a combination of the input variable selections of the records of the training and of the testing datasets of the first or previous population of father and mother prediction algorithms according to the rules of the evolutionary algorithm for each generation of new prediction algorithms representing each new variant selection of input variables, the best prediction algorithm according to the best hypothesis of input variable selection is tested or validated by means of the testing dataset; a fitness score is evaluated and the prediction algorithms representing the selections of input variables which have the best testing performance with the minimum number of input variables utilized are promoted for the processing of new generations; repeating the steps i) to k) until a predetermined fitness score defined as best fit of the prediction algorithm and a minimum number of input variables has been reached; m) defining as the selected relevant input variables i.e. as the relevant genes or polymorphisms and/or of mutations and/or of functionally equivalent genes thereof the ones related to the input variables of the selection represented by the prediction algorithm having both at least the predetermined fitness score and also the minimum number of selected input variables.

Feldgajer teaches defining two or more different training datasets each one having records with a set of input variables obtained by excluding one or more input variables from the originally defined number of input variables. while for each record the set of input variables of the corresponding training set has at least one input variable which is not a member of the set of input variables of the other training datasets, each said at least one input variable consisting in a different gene or a different polymorphisms and/or a different mutation and/or a different functionally equivalent gene thereof of the originally considered genes or polymorphisms and/or mutations and/or functionally equivalent genes thereof considered theoretically potentially relevant for the biologic or pathologic condition(**Feldgajer,** C3:62 through C4:30; 'A different gene or a different polymorphisms and/or a different mutation and/or a different functionally equivalent gene thereof of the originally considered genes or polymorphisms and/or mutations and/or functionally equivalent genes' of applicant is equivalent to genetic algorithms which the basic properties are 'mutation, evaluation and selection' of Feldgajer.) training the prediction algorithm with each of the different training sets defined under point e) for generating a first population of different prediction algorithm which are divided into two groups of mother and father prediction algorithms and testing the said prediction algorithms with the associated testing set (**Feldgajer,** C3:62 through C4:30; 'Mother' and 'Father' of applicant would be used in the 'crossover' portion of genetic algorithms of Feldgajer.) calculating a fitness score or prediction accuracy of each father and mother prediction algorithms of the said first population by means of the testing results (**Feldgajer,** C3:62 through C4:30;

'Calculating a fitness score or prediction accuracy' of applicant is equivalent to 'evaluation' of Feldgajer.); providing a so called evolutionary algorithm such a genetic algorithm and applying the evolutionary algorithm to the first population of mother and father prediction algorithms for achieving new generation of prediction algorithms whose training and testing dataset comprises records whose input variables selections are a combination of the input variable selections of the records of the training and of the testing datasets of the first or previous population of father and mother prediction algorithms according to the rules of the evolutionary algorithm (**Feldgajer,** C3:62 through C4:30; "Genetic algorithm' of applicant is equivalent to 'genetic algorithm' of Feldgajer.) for each generation of new prediction algorithms representing each new variant selection of input variables, the best prediction algorithm according to the best hypothesis of input variable selection is tested or validated by means of the testing dataset (**Feldgajer,** C3:62 through C4:64; 'Each generation of new prediction algorithms representing each new variant selection' of applicant is equivalent to 'new parameter values are assigned to the plurality of groups' of Feldgajer.); a fitness score is evaluated and the prediction algorithms representing the selections of input variables which have the best testing performance with the minimum number of input variables utilized are promoted for the processing of new generations (**Feldgajer,** C3:62 through C4:64; 'Fitness score is evaluated' of applicant is illustrated by finding the 'best fit' based on the 'parameter value' of Feldgajer.); repeating the steps i) to k) until a predetermined fitness score defined as best fit of the prediction algorithm and a minimum number of input variables has been reached (**Feldgajer,** C7:50 through C8:17; 'Repeating the steps' of

applicant is equivalent to 'the method is performed iteratively' of Feldgajer.); m) defining as the selected relevant input variables i.e. as the relevant genes or polymorphisms and/or of mutations and/or of functionally equivalent genes thereof the ones related to the input variables of the selection represented by the prediction algorithm having both at least the predetermined fitness score and also the minimum number of selected input variables. (**Feldgajer,** C7:34 through C8:17; 'Minimum number of selected input variables' of applicant is illustrated by a genetic algorithm is used to 'reduce the amount of information required to generate an adequate result' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by using a training set and a testing set and incorporating a genetic algorithm to alter the weights of a neural network as taught by Feldgajer by defining two or more different training datasets each one having records with a set of input variables obtained by excluding one or more input variables from the originally defined number of input variables. while for each record the set of input variables of the corresponding training set has at least one input variable which is not a member of the set of input variables of the other training datasets, each said at least one input variable consisting in a different gene or a different polymorphisms and/or a different mutation and/or a different functionally equivalent gene thereof of the originally considered genes or polymorphisms and/or mutations and/or functionally equivalent genes thereof considered theoretically potentially relevant for the biologic or pathologic condition training the prediction algorithm with each of the different training sets defined under point e) for generating a first population of different prediction algorithm which are

divided into two groups of mother and father prediction algorithms and testing the said prediction algorithms with the associated testing set calculating a fitness score or prediction accuracy of each father and mother prediction algorithms of the said first population by means of the testing results; providing a so called evolutionary algorithm such a genetic algorithm and applying the evolutionary algorithm to the first population of mother and father prediction algorithms for achieving new generation of prediction algorithms whose training and testing dataset comprises records whose input variables selections are a combination of the input variable selections of the records of the training and of the testing datasets of the first or previous population of father and mother prediction algorithms according to the rules of the evolutionary algorithm for each generation of new prediction algorithms representing each new variant selection of input variables, the best prediction algorithm according to the best hypothesis of input variable selection is tested or validated by means of the testing dataset; a fitness score is evaluated and the prediction algorithms representing the selections of input variables which have the best testing performance with the minimum number of input variables utilized are promoted for the processing of new generations; repeating the steps i) to k) until a predetermined fitness score defined as best fit of the prediction algorithm and a minimum number of input variables has been reached; m) defining as the selected relevant input variables i.e. as the relevant genes or polymorphisms and/or of mutations and/or of functionally equivalent genes thereof the ones related to the input variables of the selection represented by the prediction algorithm having both at least the predetermined fitness score and also the minimum number of selected input variables.

For the purpose of using the genetic algorithm to decrease the training time and with the possibility of reducing input parameters.

Claim 31

Buscema does not teach an optimization of the distribution of the records of the original database in a training dataset and in a testing dataset is carried out in one of a pre processing and a post processing phase, i.e. before carrying out the steps e) to m) at step d) or after having carried out the steps a) to m)

Feldgajer teaches an optimization of the distribution of the records of the original database in a training dataset and in a testing dataset is carried out in one of a pre processing and a post processing phase, i.e. before carrying out the steps e) to m) at step d) or after having carried out the steps a) to m) (**Feldgajer,** C10:16-26; 'Optimization of the distribution' of applicant is equivalent to 'method using groups' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by optimizing the distribution of records as taught by Feldgajer to have an optimization of the distribution of the records of the original database in a training dataset and in a testing dataset is carried out in one of a pre processing and a post processing phase, i.e. before carrying out the steps e) to m) at step d) or after having carried out the steps a) to m)

For the purpose of getting a true random sample to reduce training costs.

Claim 32

Buscema teaches defining a set of one or more distributions of the database records onto respective training and testing subsets (**Buscema,** p2, c2:16-34, p4 Figure 4; 'Training subset' of applicant is equivalent to 'training set' of Buscema. 'Testing subset' of applicant is equivalent to 'testing set' of Buscema.); using the defined set of distributions to train and test a first generation set of one or more prediction algorithms and assigning a fitness score to each. (**Buscema**, p4 Figure 4; 'defined set of distributions' of applicant is illustrated in the 'training side' and 'validation side' of each ANN of Buscema.)

Buscema does not teach feeding the set of prediction algorithms to an evolutionary algorithm which generates a set of one or more second generation prediction algorithms and assigns a fitness score to each; and continuing to feed each generational set of prediction algorithms to the evolutionary algorithm until a termination event occurs where said termination event is at least one of a prediction algorithm is generated with a fitness score equaling or exceeding a defined minimum value, the maximum fitness score of successive generational sets of prediction algorithms converging to a given value, and a certain number of generations having been generated.

Feldgajer teaches feeding the set of prediction algorithms to an evolutionary algorithm which generates a set of one or more second generation prediction algorithms and assigns a fitness score to each (**Feldgajer,** C4:43-64; 'generates a set of one or more second generation prediction algorithms' of applicant is disclosed by the 'new parameter values are assigned to the plurality of groups' of Feldgajer.); and continuing to feed each generational set of prediction algorithms to the evolutionary algorithm until a termination event occurs (**Feldgajer,** C3:62 through C4:28; 'Termination' of applicant is equivalent to

'termination condition' of Feldgajer.) where said termination event is at least one of a prediction algorithm is generated with a fitness score equaling or exceeding a defined minimum value, the maximum fitness score of successive generational sets of prediction algorithms converging to a given value, and a certain number of generations having been generated. (**Feldgajer,** C2:1-26, C5:63-64, C7:50 through C8:17; 'Exceeding a defined minimum' of applicant is disclosed by the neuron and its 'internal potential limit' of Feldgajer. This node can be viewed as the output node of the neural network. The node will fire if the .minimum value' is equaled or exceeded. 'Converging to a given value' of applicant is illustrated by the method of employing 'a convergent result.' Of Feldgajer. 'Certain number of generations' of applicant is equivalent to generation counter' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by using a genetic algorithm to alter the weights of a neural network as taught by Feldgajer to have the set of prediction algorithms to an evolutionary algorithm which generates a set of one or more second generation prediction algorithms and assigns a fitness score to each; and continuing to feed each generational set of prediction algorithms to the evolutionary algorithm until a termination event occurs where said termination event is at least one of a prediction algorithm is generated with a fitness score equaling or exceeding a defined minimum value, the maximum fitness score of successive generational sets of prediction algorithms converging to a given value, and a certain number of generations having been generated.

For the purpose of using the genetic algorithm to decrease the training time and with the possibility of reducing input parameters.

Claim 33

Buscema teaches generating a population of prediction algorithm each one of them is trained and tested according to a different distribution of the records of the data set in the complete database onto a training data set and a testing data set. (**Buscema,** p2, c2:16-34, p4 Figure 4; 'Training subset' of applicant is equivalent to 'training set' of Buscema. 'Testing subset' of applicant is equivalent to 'testing set' of Buscema. 'Population of prediction algorithm' of applicant is equivalent to 'ANN1 through ANN n' of Buscema.)

Buscema does not teach each different distribution being created by a random or pseudo-random distribution.

Feldgajer teaches each different distribution being created by a random or pseudo-random distribution. (**Feldgajer,** p7:50 through C8:17; 'Random or pseudo-random' of applicant is equivalent to 'random or pseudo-random' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by using random or pseudo random techniques as taught by Feldgajer to have a different distribution being created by a random or pseudo-random distribution.

For the purpose of using another method for finding a true random sample.

Buscema teaches each prediction algorithm of the said population is trained according to its own distribution of records of the training set and is validated in a blind way according its own distribution on the testing set. (**Buscema**, p4 Figure 4; 'Trained according to its own distribution' and 'validated in a blind way according its own distribution'

of applicant is illustrated in the 'training side' and 'validation side' of each ANN of Buscema.)

Buscema does not teach a score reached by each prediction algorithm is calculated in the testing phase representing its fitness; - an evolutionary algorithm being further provided which combines the different models of distribution of the records of the complete data set in a training and in a testing set which sets are represented each one by a corresponding prediction algorithm trained and tested on the basis of the said training and testing data set according to the fitness score calculated in the previous step for the corresponding prediction algorithm the fitness score of each prediction algorithm corresponding to one of the different distributions of the complete data set on the training and the testing data sets being the probability of evolution of each prediction algorithm or of each said distribution of the complete data set on the training and testing data sets repeating the evolution of the prediction algorithm generation for a finite number of generations or till the output of the genetic algorithm converges to a best solution and/or till the fitness value of at least some prediction algorithm related to an associated data records distribution has reached a desired value setting the data records distribution for the best solution as the optimized training and testing subsets for training and testing prediction algorithm.

Feldgajer teaches a score reached by each prediction algorithm is calculated in the testing phase representing its fitness; - an evolutionary algorithm being further provided which combines the different models of distribution of the records of the complete data set in a training and in a testing set which sets are represented each one by a corresponding

prediction algorithm trained and tested on the basis of the said training and testing data set according to the fitness score calculated in the previous step for the corresponding prediction algorithm (**Feldgajer,** p4:43-64; 'A score is reached by each prediction algorithm' of applicant by being able to determine which set of parameters provides the 'best fit' of Feldgajer.) the fitness score of each prediction algorithm corresponding to one of the different distributions of the complete data set on the training and the testing data sets being the probability of evolution of each prediction algorithm or of each said distribution of the complete data set on the training and testing data sets (**Feldgajer,** p4:43-64; 'A fitness score of each prediction algorithm' of applicant by being able to determine which set of parameters provides the 'best fit' of Feldgajer.) repeating the evolution of the prediction algorithm generation for a finite number of generations or till the output of the genetic algorithm converges to a best solution and/or till the fitness value of at least some prediction algorithm related to an associated data records distribution has reached a desired value (**Feldgajer,** p7:50 through C8:17; 'Repeating the evolution' of applicant is equivalent to 'the method is performed iteratively' of Feldgajer.) setting the data records distribution for the best solution as the optimized training and testing subsets for training and testing prediction algorithm. (**Feldgajer,** p7:50 through C8:17; 'Setting the data records' of applicant is equivalent to 'altering the population or the parameter values' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by using fitness scores to determine the standing of a neural network and it's associated values from the genetic algorithm as taught by Feldgajer to have a score reached by each

prediction algorithm is calculated in the testing phase representing its fitness; - an evolutionary algorithm being further provided which combines the different models of distribution of the records of the complete data set in a training and in a testing set which sets are represented each one by a corresponding prediction algorithm trained and tested on the basis of the said training and testing data set according to the fitness score calculated in the previous step for the corresponding prediction algorithm the fitness score of each prediction algorithm corresponding to one of the different distributions of the complete data set on the training and the testing data sets being the probability of evolution of each prediction algorithm or of each said distribution of the complete data set on the training and testing data sets repeating the evolution of the prediction algorithm generation for a finite number of generations or till the output of the genetic algorithm converges to a best solution and/or till the fitness value of at least some prediction algorithm related to an associated data records distribution has reached a desired value setting the data records distribution for the best solution as the optimized training and testing subsets for training and testing prediction algorithm.

For the purpose of being able to find the neural network with the best fit to use as a bases for a following iteration.

Claim 34

Buscema does not teach a reduced number of genes, alleles or polymorphisms characterized in that the reduced number of the said genes, alleles or polymorphisms has been selected by means of a method according to claims 30 to 33.

Feldgajer teaches a reduced number of genes, alleles or polymorphisms characterized in that the reduced number of the said genes, alleles or polymorphisms has been selected by means of a method according to claims 30 to 33. (**Feldgajer,** C7:34 through C8:17; 'Reduced number of genes, alleles or polymorphisms' of applicant is illustrated by a genetic algorithm is used to 'reduce the amount of information required to generate an adequate result' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by reducing input values as taught by Feldgajer to have a reduced number of genes, alleles or polymorphisms characterized in that the reduced number of the said genes, alleles or polymorphisms has been selected by means of a method according to claims 30 to 33.

For the purpose of making the neural network more efficient.

Claim 35

Buscema teaches defining a set of one or more distributions of the database records onto respective training and testing subsets. (**Buscema,** p2, c2:16-34; 'Training subset' of applicant is equivalent to 'training set' of Buscema. 'Testing subset' of applicant is equivalent to 'testing set' of Buscema.)

Buscema does not teach using the defined set of distributions to train and test a first generation set of one or more prediction algorithms and assigning a fitness score to each, each of said prediction algorithms being associated with a certain distribution of said records; feeding the set of prediction algorithms to an evolutionary algorithm which

generates a set of one or more second generation prediction algorithms and assigns a fitness score to each; continuing to feed each generational set of prediction algorithms to the evolutionary algorithm until a termination event occurs, where said termination event is at least one of a prediction algorithm is generated with a fitness score equal to or exceeding a defined minimum value, the maximum fitness score of successive generational sets of prediction algorithms converging to a given value, and a certain number of generations having been generated; selecting a prediction algorithm having a best fitness score.

Feldgajer teaches using the defined set of distributions to train and test a first generation set of one or more prediction algorithms and assigning a fitness score to each, each of said prediction algorithms being associated with a certain distribution of said records (**Feldgajer,** abstract, C4:43-64; 'Set of distributions to train and test a first generation set' of applicant is equivalent to 'using genetic algorithms' which generate 'parameter values preferably define a first broad range of values' of Feldgajer. 'Fitness score' of applicant is illustrates by finding output with the 'best fit' of Feldgajer.);feeding the set of prediction algorithms to an evolutionary algorithm which generates a set of one or more second generation prediction algorithms and assigns a fitness score to each(**Feldgajer,** abstract, C4:43-64; 'Feeding the set of prediction algorithms to an evolutionary algorithm which generates a set of one or more second generation prediction algorithms' of applicant is disclosed by 'new parameters values are assigned to the plurality of groups' of Feldgajer.); continuing to feed each generational set of prediction algorithms to the evolutionary algorithm until a termination event occurs,

where said termination event is at least one of a prediction algorithm is generated with a fitness score equal to or exceeding a defined minimum value (**Feldgajer,** C2:1-26; 'Exceeding a defined minimum' of applicant is disclosed by the neuron and its 'internal potential limit' of Feldgajer. This node can be viewed as the output node of the neural network. The node will fire if the .minimum value' is equaled or exceeded.), the maximum fitness score of successive generational sets of prediction algorithms converging to a given value (**Feldgajer,** C5:63-64; 'Converging to a given value' of applicant is illustrated by the method of employing 'a convergent result.' Of Feldgajer.), and a certain number of generations having been generated (**Feldgajer,** C7:50 through C8:17; 'Certain number of generations' of applicant is equivalent to generation counter' of Feldgajer.); selecting a prediction algorithm having a best fitness score. (**Feldgajer**, C4:43-64; 'Fitness score' of applicant is illustrates by finding output with the 'best fit' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by using initial distributions of data with an neural network which results in fitness scores which are then passed into a genetic algorithm for altering the value to improve the fitness level of the neural networks with the next iteration as taught by Feldgajer to have the defined set of distributions to train and test a first generation set of one or more prediction algorithms and assigning a fitness score to each, each of said prediction algorithms being associated with a certain distribution of said records; feeding the set of prediction algorithms to an evolutionary algorithm which generates a set of one or more second generation prediction algorithms and assigns a fitness score to each; continuing to feed

each generational set of prediction algorithms to the evolutionary algorithm until a termination event occurs, where said termination event is at least one of a prediction algorithm is generated with a fitness score equal to or exceeding a defined minimum value, the maximum fitness score of successive generational sets of prediction algorithms converging to a given value, and a certain number of generations having been generated; selecting a prediction algorithm having a best fitness score.

For the purpose of reducing the cost of the training of the neural network.

Buscema teaches using the distribution of database records associated with said selected prediction algorithm in performing supervised learning, said supervised learning including training and testing pf prediction algorithms to obtain a trained prediction algorithm (**Buscema,** p4, Figure 4; 'Using the distribution of database records' of applicant is equivalent to 'Total DB' of Buscema.); and using the trained prediction algorithm to predict the output variables relating to the problem under investigation where only the input variables are known. (**Buscema,** p2:16-39; 'To predict the output variables' of applicant is equivalent to 'classify the new cases' of Buscema.)

Buscema does not teach wherein said method is performed using a computer and computer software forming an intelligent system.

Feldgajer teaches wherein said method is performed using a computer and computer software forming an intelligent system. (**Feldgajer**, C4:43-64; 'Computer and computer software' of applicant is equivalent to 'computer' of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's

invention to modify the teachings of Buscema by using a computer to implement the invention as taught by Feldgajer to have the method is performed using a computer and computer software forming an intelligent system.

For the purpose of being able to implement the invention with a common machine.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 10, 14, 21, 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Buscema and Feldgajer in view of Lapointe. (U. S. Patent Publication 20030004906, referred to as **Lapointe**)

Claim 10

Buscema and Feldgajer do not teach the steps of said method for optimizing a database of sample records, for selecting the most predictive input variables.

Lapointe teaches the steps of said method for optimizing a database of sample records, for selecting the most predictive input variables. (**Lapointe,** ¶0099; 'Optimizing a database' of applicant is achieved by the 'greedy algorithm' of Lapointe.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Buscema and Feldgajer by using the best results as taught by Lapointe to have the steps of said method for optimizing a database of sample records, for selecting the most predictive input variables.

For the purpose of starting the next generation based on the most predictive inputs for efficient training.

Claim 14

Buscema and Feldgajer do not teach an average health value of the population is computed as a function of the fitness values of each single individual in the population; coupling, recombination of genes and mutation of genes are carried out in a differentiated manner depending on the a comparison between the fitness of each individual of the couple and the average health value of the entire population to which the individuals belong; individuals having a fitness value lower or equal to the average health of the entire population are not excluded from the creation of new generations but are marked out and entered in a vulnerability list; the number of subjects entered in the vulnerability list defining the number of possible marriages.

Lapointe teaches an average health value of the population is computed as a function of the fitness values of each single individual in the population (**Lapointe,** ¶0019; Lapointe invention is in regards to a woman's health.); coupling, recombination of genes and mutation of genes are carried out in a differentiated manner depending on the a comparison between the fitness of each individual of the couple and the average health value of the entire population to which the individuals belong (**Lapointe,** ¶0013 (for 'differentiated manner') and ¶0137; 'Recombination' and 'mutation' of applicant is equivalent to 'genetic algorithms' of Lapointe.); individuals having a fitness value lower or equal to the average health of the entire population are not excluded from the creation of new generations but are marked out and entered in a vulnerability list (**Lapointe,** ¶0430; Since applicant does not exclude the creation that is below a fitness value, this is equivalent to the contingency table of Lapointe. If the information is above a fitness level of applicant then it is on the contingency table of Lapointe. Below a given fitness value would be equivalent to 'vulnerability list.'); the number of subjects entered in the vulnerability list defining the number of possible marriages. (**Lapointe,** ¶0100; Since not all of the population is not involved with marriages then they (vulnerability list) 'defines' the number of possible marriages.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Buscema and Feldgajer by not using individuals which are below the average as taught by Lapointe to have an average health value of the population is computed as a function of the fitness values of each single individual in the population; coupling, recombination of genes and mutation of genes are carried out in a differentiated manner depending on

the a comparison between the fitness of each individual of the couple and the average health value of the entire population to which the individuals belong; individuals having a fitness value lower or equal to the average health of the entire population are not excluded from the creation of new generations but are marked out and entered in a vulnerability list; the number of subjects entered in the vulnerability list defining the number of possible marriages.

For the purpose of using individuals with a promising result to be the bases of the next iteration.

Claim 21

Buscema teaches in which the individuals are the different prediction algorithm representing a corresponding different initial random distribution of data records onto the testing and the training data set and the genes consist in the binary status variable of association of each record to the training and to the testing subset. (**Buscema,** p2, C2:16-34; 'Initial random distribution' of applicant is equivalent to 'random sample' of Buscema.)

Claim 22

Buscema teaches in which the individuals are the prediction algorithms each one representing a different training and testing data set, the difference residing in a different selection of input variables for each different training and testing subset, and the genes consist in the different selection variable which is provided for each

input variable in the different training and testing subsets, the above mentioned selection variable being a parameter indicating the presence/absence of each corresponding input variable in the records of each data set. (**Buscema,** p2, C2:16-34, p4, Figure 4; Buscema discloses different training and validation sets. Figure 4 illustrates both testing and validation have within them 'present/absent' categories.)

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 15, 16, 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Buscema and Feldgajer as set forth above in view of Boden. (U. S. Patent 5708774, referred to as **Boden**)

Claim 15

Buscema and Feldgajer do not teach in which for coupling purposes and for generation of children at least one parent individuals must have a fitness value greater than the average health value of the population.

Boden teaches in which for coupling purposes and for generation of children at least one parent individuals must have a fitness value greater than the average health value of the population. (**Boden,** C6:6-15; 'Average health value' of applicant is equivalent to 'relative fitness' of Boden. Per Boden individuals with a low fitness value may not be selected. Thus, 'Couples with both members that are below the relative fitness level will not be selected.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Buscema and Feldgajer by having an algorithm for selection as taught by Boden to have in which for coupling purposes and for generation of children at least one parent individuals must have a fitness value greater than the average health value of the population.

For the purpose of not selecting both pairs that are below the average health value.

Claim 16

Buscema and Feldgajer do not teach in that each couple of individuals can generate individuals having a fitness different from the average health, so called offsprings if the fitness of one them, at least is greater than the average fitness, the offsprings of each marriage occupying the places of subjects entered in the vulnerability

list and are marked out, so that a weak individual can continue to exist through his own children.

Boden teaches in that each couple of individuals can generate individuals having a fitness different from the average health, so called offsprings if the fitness of one them, at least is greater than the average fitness, the offsprings of each marriage occupying the places of subjects entered in the vulnerability list and are marked out, so that a weak individual can continue to exist through his own children. (**Boden,** C6:6-15; If a parent is chosen to have a child then it is due to the fact is was a child which has a different fitness value than it's parents. If it did not then there would be no improvement within the algorithm.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Buscema and Feldgajer by choosing one parent above and the second parent below the average health value as taught by Boden to have in that each couple of individuals can generate individuals having a fitness different from the average health, so called offsprings if the fitness of one them, at least is greater than the average fitness, the offsprings of each marriage occupying the places of subjects entered in the vulnerability list and are marked out, so that a weak individual can continue to exist through his own children.

For the purpose of allowing the weaker parent to generate offspring that might be above the average health value.

Claim 17

Buscema and Feldgajer do not teach in that coupling between individuals having a very low fitness value and a very high fitness value are not allowed.

Boden teaches in that coupling between individuals having a very low fitness value and a very high fitness value are not allowed. (**Boden,** C6:6-15; "Low fitness value' are not chosen to have children.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Buscema and Feldgajer by not allowing parents that are below the average health value to generate offspring as taught by Boden to have in that coupling between individuals having a very low fitness value and a very high fitness value are not allowed.

For the purpose of eliminating generations of offspring that will be below the average health value.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 18, 19, 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Buscema, Feldgajer and Lapointe as set forth above, in view of Burke and Boden. ('A Genetic Algorithm Tutorial Tool for Numerical Function Optimisation', referred to as **Burke;** U. S. Patent 5708774, **referred to as Boden**)

Claim 18

Buscema, Feldgajer and Lapointe do not teach in that the following recombination rules of the genes of the parents individuals coupled are considered in the case the parents individuals have not common genes.

Burke teaches in that the following recombination rules of the genes of the parents individuals coupled are considered in the case the parents individuals have not common genes. (**Burke,** p29, C2:10-20; 'Not have common genes' of applicant is controlled by Burke's 'Incest laws 0-3'.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Buscema, Feldgajer and Lapointe by considering parents with genes not in common as taught by Burke to have in that the following recombination rules of the genes of the parents individuals coupled are considered in the case the parents individuals have not common genes.

For the purpose of starting with a broader domain of genes to avoid a local minimum.

Buscema, Feldgajer do not teach the health of father and mother individuals are greater than the average health of the entire population; the crossover is a classical

crossover according to which the genes of the father and of the mother individuals are substituted one with the other starting from a certain crossover point; the health of father and mother individuals are lower than the average health of the entire population; in this case the two children are formed through rejection of the parents genes they will receive by the crossover process.

Lapointe teaches the health of father and mother individuals are greater than the average health of the entire population; the crossover is a classical crossover according to which the genes of the father and of the mother individuals are substituted one with the other starting from a certain crossover point (**Lapointe,** ¶0100); the health of father and mother individuals are lower than the average health of the entire population; in this case the two children are formed through rejection of the parents genes they will receive by the crossover process. (**Lapointe,** ¶0034, 'Through rejection of the parents genes is equivalent to a 'sliding window' or an average of the variable.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Buscema and Feldgajer by using individuals which are greater than the average as taught by Lapointe to the health of father and mother individuals are greater than the average health of the entire population; the crossover is a classical crossover according to which the genes of the father and of the mother individuals are substituted one with the other starting from a certain crossover point; the health of father and mother individuals are lower than the average health of the entire population; in this case the two children are formed through rejection of the parents genes they will receive by the crossover process.

For the purpose of using crossover with fit parents for better results.

Buscema, Feldgajer and Lapointe do not teach the health of one of the parents is less than the average health of the entire population while the health of the other parent is greater than the average health of the entire population; in this case only the parents whose health is greater than the average health of the entire population will transmit their genes, while the genes of the parent having an health lower than the average health of the entire population are rejected.

Boden teaches the health of one of the parents is less than the average health of the entire population while the health of the other parent is greater than the average health of the entire population; in this case only the parents whose health is greater than the average health of the entire population will transmit their genes, while the genes of the parent having an health lower than the average health of the entire population are rejected. (**Boden,** C6:6-15; Rejection of the parent which is below the average of applicant is equivalent to 'low fitness value may not be selected' of Boden.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Buscema, Feldgajer and Lapointe by stating the rule where parents with below average health value will not pass on their genes as taught by Boden to have the health of one of the parents is less than the average health of the entire population while the health of the other parent is greater than the average health of the entire population; in this case only the parents whose health is greater than the average health of the entire population will transmit their

genes, while the genes of the parent having an health lower than the average health of the entire population are rejected.

For the purpose of following the general guidelines of a genetic algorithm.

Claim 19

Buscema does not teach wherein each gene is characterised by a status level, the method further characterized in that genes rejection consists in modifying the status of the genes from one status level to a different status level.

Feldgajer teaches wherein each gene is characterised by a status level, the method further characterized in that genes rejection consists in modifying the status of the genes from one status level to a different status level. (**Feldgajer,** C4:28-30; 'Modifying the status' of a gene is accomplished by replacing the worst individuals with the best individuals of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by changing status levels as taught by Feldgajer to have each gene is characterised by a status level, the method further characterized in that genes rejection consists in modifying the status of the genes from one status level to a different status level.

For the purpose of improving the status for improved results with the next iteration.

Claim 20

Buscema does not teach in that a modified crossover of the genes of the parents individuals is carried out when the parents individuals has part of the genes that coincide, this modified crossover provides for generating and offspring in which the genes selected for crossover are the most effective ones of the parents.

Feldgajer teaches in that a modified crossover of the genes of the parents individuals is carried out when the parents individuals has part of the genes that coincide, this modified crossover provides for generating and offspring in which the genes selected for crossover are the most effective ones of the parents. (**Feldgajer,** C3:62 through C4:30; 'Parents' of applicant would be used in the 'crossover' portion of genetic algorithms of Feldgajer.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema by using better parents, better offspring are created using crossover as taught by Feldgajer to have a modified crossover of the genes of the parents individuals is carried out when the parents individuals has part of the genes that coincide, this modified crossover provides for generating and offspring in which the genes selected for crossover are the most effective ones of the parents.

For the purpose of improving the status for improved results with the next iteration.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 26, 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Buscema and Feldgajer as set forth above in view of Rose. (U. S. Patent Publication 20020178132, referred to as **Rose**)

Claim 26

Buscema and Feldgajer do not teach in that it is a system for sound or vocal recognition comprising input means responsive to acoustic waves, a processing unit connected to the input means responsive to acoustic waves, at least a memory in which a software program is stored the said program being in the form according to claims 23 or 24 and comprising coded instructions for enabling the processing unit to carry out a method according to claim 1, a further or the same above mentioned memory in which a dataset of known data records is stored or can be stored and/or input means for storing in the further or the said above mentioned memory a dataset of known data records.

Rose teaches in that it is a system for sound or vocal recognition comprising input means responsive to acoustic waves, a processing unit connected to the input

means responsive to acoustic waves, at least a memory in which a software program is stored the said program being in the form according to claims 23 or 24 and comprising coded instructions for enabling the processing unit to carry out a method according to claim 1, a further or the same above mentioned memory in which a dataset of known data records is stored or can be stored and/or input means for storing in the further or the said above mentioned memory a dataset of known data records. (**Rose,** ¶0015) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Buscema and Feldgajer by having data be related to sound or acoustic waves as taught by Rose to have in that it is a system for sound or vocal recognition comprising input means responsive to acoustic waves, a processing unit connected to the input means responsive to acoustic waves, at least a memory in which a software program is stored the said program being in the form according to claims 23 or 24 and comprising coded instructions for enabling the processing unit to carry out a method according to claim 1, a further or the same above mentioned memory in which a dataset of known data records is stored or can be stored and/or input means for storing in the further or the said above mentioned memory a dataset of known data records.

For the purpose of utilizing the invention within a real world environment.

Claim 28

Buscema and Feldgajer do not teach in that the database of known data records comprises acoustic signals emitted by one or more objects or one or more living beings

making part of the typical environment in which the device has to operate or the data relating to one or more images of one or more objects or one or more living beings making part of the typical environment in which the device has to operate to which are univoquely correlated to corresponding known kind, and/or identity and/or meaning of objects to which the said acoustic signals or image data are related and/or from which the said acoustic signals or image data are generated.

Rose teaches in that the database of known data records comprises acoustic signals emitted by one or more objects or one or more living beings making part of the typical environment in which the device has to operate or the data relating to one or more images of one or more objects or one or more living beings making part of the typical environment in which the device has to operate to which are univoquely correlated to corresponding known kind, and/or identity and/or meaning of objects to which the said acoustic signals or image data are related and/or from which the said acoustic signals or image data are generated. (**Rose, ¶0004**) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Buscema and Feldgajer by using signals to detect living beings as taught by Rose to have in that the database of known data records comprises acoustic signals emitted by one or more objects or one or more living beings making part of the typical environment in which the device has to operate or the data relating to one or more images of one or more objects or one or more living beings making part of the typical environment in which the device has to operate to which are univoquely correlated to corresponding known kind, and/or identity and/or meaning of objects to

which the said acoustic signals or image data are related and/or from which the said acoustic signals or image data are generated.

For the purpose of detecting living beings to aid in rendering a decision to an environment.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Buscema and Feldgajer as set forth above in view of Breed. (U. S. Patent Publication 20030002690, referred to as **Breed**)

Claim 27

Buscema and Feldgajer do not teach in that it is a system for image recognition, the input means being responsible to electromagnetic waves, the system being able to recognize the shape of an object generating or reflecting electromagnetic waves, and/or the distance and/or the identity of the object.

Breed teaches in that it is a system for image recognition, the input means being responsible to electromagnetic waves, the system being able to recognize the shape of an object generating or reflecting electromagnetic waves, and/or the distance and/or the identity of the object. (**Breed,** abstract) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Buscema and Feldgajer by using image data I the form of electromagnetic waves as taught by Breed to have in that it is a system for image recognition, the input means being responsible to electromagnetic waves, the system being able to recognize the shape of an object generating or reflecting electromagnetic waves, and/or the distance and/or the identity of the object.

For the purpose of implementing the invention for use for image recognition.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Buscema, Feldgajer and Breed as set forth above in view of Lapointe. (U. S. Patent Publication 20030004906, referred to as **Lapointe**)

Claim 29

Buscema, Feldgajer and Breed do not teach a specialized system for image pattern recognition having artificial intelligence utilities for analyzing a digitalized image, i.e. an image in the form of a array of image data records, each image data record being related to a zone or point or unitary area or volume of a two or three dimensional visual image, so called pixel or voxel of a visual image, the said visual image being formed by an array of the said pixels or voxels and utilities for indicating for each image data record a certain quality among a plurality of known qualifies of the image data records; the system having a processing unit as for example a conventional computer, a memory in which an image pattern recognition algorithm is stored in the form of a software program which can be executed by the processing unit, a memory in which a certain number of predetermined different qualities which the image data records can assume has been stored and which qualities has to be univoquely associated to each of the image data records of an image data array fed to the system, input means for receiving arrays of digital image data records or input means for generating arrays of digital image data records from an existing image and a memory for storing the said digital image data array, output means for indicating for each image data record of the image data array a certain quality chosen by the processing unit in carrying out the image

pattern recognition algorithm in the form of the said software program; the image pattern recognition algorithm is a prediction algorithm in the form of a software program, which prediction algorithm is further associated to a system being further provided with a training and testing software program, the system is able to carry out training and testing according to the method of one or more of the preceding claims 1 to 22, the method is provided in the system in the form of the training and testing software program, a database being also provided in which data records are contained univoquely associating known image data records of known image data arrays with the corresponding known quality from a certain number of predetermined different qualities which the image data records can assume.

Lapointe teaches a specialized system for image pattern recognition having artificial intelligence utilities for analyzing a digitalized image (**Lapointe,** ¶0001 and ¶0148; 'Artificial intelligence' of applicant is equivalent to 'neural networks' of Lapointe.), i.e. an image in the form of a array of image data records, each image data record being related to a zone or point or unitary area or volume of a two or three dimensional visual image, so called pixel or voxel of a visual image (**Lapointe,** ¶0148; 'Pixel or voxel' of applicant is equivalent to 'Images are digitized' of Lapointe.), the said visual image being formed by an array of the said pixels or voxels and utilities for indicating for each image data record a certain quality among a plurality of known qualifies of the image data records (**Lapointe,** ¶0148; 'Array' of applicant is equivalent to 'fixed dimension' of Lapointe.); the system having a processing unit as for example a conventional computer, a memory in which an image pattern recognition algorithm is stored in the

form of a software program which can be executed by the processing unit (**Lapointe,** ¶0006), a memory in which a certain number of predetermined different qualities which the image data records can assume has been stored and which qualities has to be univoquely associated to each of the image data records of an image data array fed to the system (**Lapointe,** ¶0006), input means for receiving arrays of digital image data records or input means for generating arrays of digital image data records from an existing image and a memory for storing the said digital image data array (**Lapointe,** ¶0006), output means for indicating for each image data record of the image data array a certain quality chosen by the processing unit in carrying out the image pattern recognition algorithm in the form of the said software program (**Lapointe,** ¶0006); the image pattern recognition algorithm is a prediction algorithm in the form of a software program, which prediction algorithm is further associated to a system being further provided with a training and testing software program (**Lapointe,** ¶0066, ¶0010), the system is able to carry out training and testing according to the method of one or more of the preceding claims 1 to 22, the method is provided in the system in the form of the training and testing software program (**Lapointe,** ¶0010), a database being also provided in which data records are contained univoquely associating known image data records of known image data arrays with the corresponding known quality from a certain number of predetermined different qualities which the image data records can assume. (**Lapointe,** ¶0006, ¶0148) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Buscema, Feldgajer and Breed by employing the system for image pattern recognition

as taught by Lapointe to have a specialized system for image pattern recognition having artificial intelligence utilities for analyzing a digitalized image, i.e. an image in the form of a array of image data records, each image data record being related to a zone or point or unitary area or volume of a two or three dimensional visual image, so called pixel or voxel of a visual image, the said visual image being formed by an array of the said pixels or voxels and utilities for indicating for each image data record a certain quality among a plurality of known qualifies of the image data records; the system having a processing unit as for example a conventional computer, a memory in which an image pattern recognition algorithm is stored in the form of a software program which can be executed by the processing unit, a memory in which a certain number of predetermined different qualities which the image data records can assume has been stored and which qualities has to be univoquely associated to each of the image data records of an image data array fed to the system, input means for receiving arrays of digital image data records or input means for generating arrays of digital image data records from an existing image and a memory for storing the said digital image data array, output means for indicating for each image data record of the image data array a certain quality chosen by the processing unit in carrying out the image pattern recognition algorithm in the form of the said software program; the image pattern recognition algorithm is a prediction algorithm in the form of a software program, which prediction algorithm is further associated to a system being further provided with a training and testing software program; the system is able to carry out training and testing according to the method of one or more of the preceding claims 1 to 22, the method is provided in the

system in the form of the training and testing software program, a database being also provided in which data records are contained univoquely associating known image data records of known image data arrays with the corresponding known quality from a certain number of predetermined different qualities which the image data records can assume.

For the purpose of using the invention to detect pathological conditions using images wherein the invention is based on neural networks trained using genetic algorithms.

Response to Arguments

5. Applicant's arguments filed on May 29, 2007 for claims 1-35 have been fully considered but are not persuasive.

6. In reference to the Applicant's argument:

Claims 1-35 are now presented for examination. Claims 1 and 2 have been amended to more particularly point out and distinctly claim the subject matter regarded as the invention. Claim 35 has been added. Claims 1, 30 and 35 are independent. Favorable review is respectfully requested.

Claims 1-29 were rejected under 35 § 101 as reciting non-statutory subject matter. The Examiner stated that the invention was not limited to a substantial practical application, and that if an optimized database were not employed in sonic fashion, it would be deemed an exercise only, without practical application.

Independent claim 1 has again been carefully reviewed and revised in light of the Examiner's comments. The claim has been amended to explicitly recite: (1) that the method is for performing a supervised learning process including optimizing a database for the training and testing of a prediction algorithm for predicting the presence or absence of a specified medical condition in a patient; (2) a step of using the distribution of database records associated with a selected prediction algorithm in performing supervised learning, said supervised learning including training and testing of prediction algorithms to obtain a trained prediction algorithm; and (3) that the trained prediction algorithm is effective to predict output variables for data relating to the medical condition, thereby predicting diagnosis of the condition. Support for this amended claim language is clearly stated in the specification, at least in paragraphs 75, 114, 120 and 123. It is respectfully submitted that amended claim 1 (along with claims 2-29 dependent therefrom) recites statutory subject matter.

New claim 35 also recites a method for performing a supervised learning process in an artificial intelligence environment, including optimizing a database of sample records. This optimizing is for the training and testing of a prediction algorithm for a problem under investigation characterized by input variables and output variables. The prediction algorithm is used for predicting output variables for real world data. Claim 35 explicitly recites a step of using the trained prediction algorithm to predict the output variables relating to the problem under investigation where only the input variables are known. This claim limitation is supported in the specification at least in paragraphs 75 and 90. Since the method of claim 35 includes training of a prediction algorithm, and the result is a prediction of output variables relating to the problem under investigation where only the input variables are known, it is submitted that claim 35 also recites statutory subject matter under 35 U.S.C. § 101.

Examiner's response:

Due to a change of Office practice, the Examiner is now allowed to search the specification for a practical application. Based of Paragraphs 0075 through 0077 the Examiner withdraws the 35 U.S.C. 101 rejection.

7. In reference to the Applicant's argument:

Claim 2 was rejected under 35 U.S.C. § 112, second paragraph. The Examiner stated that the term "pseudo-random" rendered the claim indefinite, as this term was not clearly defined or an accepted term in the art. In response to the Examiner's comments,

claim 2 has been amended to recite that each different distribution of the records of the data set is created as one of a random distribution and a distribution formed by a deterministic mathematical process characterized as a pseudorandom distribution. Each of the recited distributions is thus either (1) random, or (2) formed by a deterministic mathematical process. A distribution formed by such a deterministic mathematical process is characterized as "pseudorandom," consistent with the meaning of this term in the mathematical and programming art. It is earnestly believed that all of the claims are in compliance with 35 U.S.C. § 112.

Examiner's response:

The rejections stands due to the fact there is no algorithm, method or formula which defines 'pseudorandom.' Without such guidelines it could have a plurality of meanings.

8. In reference to the Applicant's argument:

Claims 1-14 and 21-25 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Lapointe et al. (U.S. Patent Application Publication 2003/0004906) in view of Arouh et al. (U.S. Patent Application Publication 2002/0077756). The applicant respectfully submits that amended claim I is patentable over the art cited by the Examiner, for the following reasons.

The present invention, as defined in claim I, is directed to a method including the step of defining one or more distributions of database records onto respective training and testing subsets; using this defined set to train and test a first generation set of prediction algorithms; and feeding those prediction algorithms to an evolutionary algorithm which generates a set of second generation algorithms. In addition, claim I recites that a fitness score is assigned to each generated prediction algorithm.

Lapointe et al. is understood to disclose a method in which a set of data is partitioned into training and testing files (paragraph 91), and training of neural networks using training partitions. Lapointe et al. does not mention generations of prediction algorithms (or generations of networks), and does not disclose or suggest an evolutionary algorithm or assigning a fitness score, as recited in claim 1. As noted by the Examiner (Office Action, page 5), Lapointe et al. does not disclose or suggest an evolutionary algorithm which generates a set of one or more second generation prediction algorithms and assigns a fitness score to each.

Furthermore, Lapointe et al. does not disclose or suggest using a fitness score as a criterion for a termination event in an evolutionary process. Since Lapointe et al, does not suggest an evolutionary algorithm, it follows that Lapointe et al. cannot suggest a selected prediction algorithm having a best fitness score, and thus cannot suggest using a distribution of records associated therewith in performing supervised learning as required by claim 1.

Arouh et al. is understood to disclose a method for construction and training of neural networks which may involve a "genetic algorithm" (Arouh et at, paragraph 226 and Figure 1E). Even if the evolutionary algorithm of claim 1 were regarded as equivalent to the genetic algorithm of Arouh et al. (a point not conceded), Arouh et al. fails to teach the evolutionary algorithm of claim 1 or the use thereof. Arouh et al. does not offer details of a selection of a prediction algorithm (or neural network) by a genetic algorithm. It is noteworthy that in Figure IE of Arouh et al., the genetic algorithm stops when a "stopping criterion" is satisfied. Even if "stopping criterion satisfied" were interpreted as "select a neural network with required fitness score" (a point also not conceded), Arouh et al. does not suggest using a distribution of database records associated with the selected neural network in performing supervised learning, as required by claim 1. Arouh et al. teaches training a neural network by limiting the inputs to that network by statistical processes (paragraphs 117-125). Arouh et al. makes it clear that the amount of input data is to be reduced, but does not suggest defining distributions of database records, let alone using such distributions in supervised learning as required by claim 1.

Moreover, Lapointe et al, does not suggest the desirability of using an evolutionary algorithm. It is respectfully submitted that the motivation to combine Lapointe et al. with Arouh et al. does not appear in the references. One reading Lapointe et at, without the benefit of impermissible hindsight, would not have been motivated to discard Lapointe et al.'s "consensus of networks" in favor of a "selected prediction algorithm" obtained by an evolutionary algorithm as in claim 1.

Even if the teachings Lapointe et at and Arouh et al. were combined, that combination would not meet the requirements of claim 1. Supposing that a neural network of Arouh et al. were obtained by a genetic algorithm; and supposing that such a network were selected as having a best fitness score (not taught or suggested in either reference); and supposing that this selected network were to be trained, there is still no suggestion in either reference, or in their combination, of using a distribution of database records in performing supervised learning. Arouh et al. might be read to suggest that a reduced database is desirable, while Lapointe et al. teaches training using partitioned data. Neither reference suggests supervised learning using a distribution of database records as recited in claim 1.

Accordingly, it is believed that neither Lapointe et al. nor Arouh et al., considered alone or in combination, renders obvious the method of independent claim 1.

Examiner's response:

'Fitness score' of applicant is illustrates by finding output with the 'best fit' of Feldgajer. Feldgajer discloses neural networks (prediction algorithms) and genetic algorithms (evolutionary algorithm). Feldgajer incorporates both neural networks using genetic algorithms. Lapointe and Arouh are no longer used as references in claim 1. Buscema and Feldgajer are used as references in claim 1. Office Action stands. In addition, the applicant does not concede that a evolutionary algorithm is not equivalent to a genetic algorithm. In 'Tavola Rotonda, Intelligenza artificiale e reti neurali: loro utilizzo per ottimizzare diagnosi, prognosi e terapia in Pediatria' the inventor states that a 'genetic algorithm' is a subset to evolutionary programming, therefore evolutionary algorithm is equivalent to 'genetic algorithms.'

9. In reference to the Applicant's argument:

Claims 15-17, indirectly dependent from claim 1, were rejected under 35 U.S.C. § 103(a) as being unpatentable over Lapointe et al. and Arouh et al. in view of Boden (U.S. Pat. No. 5,708,774). The applicant respectfully submits that amended claim 15 is patentable over the cited art, for the following reasons.

Claims 15-17 all directly depend from claim 14 and incorporates all of the features of claim 14. Claims 15-17 thus characterize the evolutionary algorithm as a genetic algorithm with certain evolutionary rules. One of these rules is that individuals

As noted above, Lapointe et al. does not suggest using an evolutionary algorithm (whether or not characterized as a genetic algorithm), and in particular does not suggest a fitness function used with an evolutionary algorithm. Furthermore, since it is concerned with a 'consensus network' with an averaged performance estimate,

Lapointe et al. does not suggest the desirability of assigning a fitness value to an algorithm, let alone using that fitness value as a criterion in an evolutionary algorithm. Lapointe et al. thus does not provide motivation for a combination with either Arouh et al. or Boden regarding a fitness value. MPEP § 2143.01.

Furthermore, Boden is understood to disclose automated testing software including a "fitness function" for evaluating individual call sequences (col. 5, line 66, to col. 6, line 15). Boden teaches (col. 6, lines 8-15) that succeeding generations are chosen based on the fitness function, and states that "individuals of low fitness value may not be selected at all." Boden therefore does not teach or suggest that individuals having a fitness value lower or equal to the average health of the entire population are marked out and entered in a vulnerability list, as required by claims 15-17.

A combination of Lapointe et al. and Arouh et al. with Boden (even if properly motivated, a point not conceded) would at best yield an evaluation scheme in which a fitness function is executed, and individuals with a below-average fitness evaluation would not be selected for the next generation. Neither of the cited references, nor a combination thereof, suggests that individuals having a fitness value lower or equal to the average health of the entire population be not excluded from the creation of new generations but rather marked out and entered in a vulnerability list. Accordingly, claims 15-17 would not have been obvious from either of the references, or from a combination thereof.

Examiner's response:

Regarding Boden, 'lower fitness value' of applicant can be seen as 'low fitness value' while, 'lower or equal' of applicant can be seen as 'high fitness.' Office Action stands.

10. In reference to the Applicant's argument:

Claims 18-20, dependent from claim 14 (and indirectly from claim 1), were rejected under 35 U.S.C. § 103(a) as being unpatentable over Lapointe et al., Arouh et al., and Boden in view of Burke et al. ("A Genetic Algorithms Tutorial Tool for Numerical Function Optimisation"). Burke et al. is understood to provide a basic teaching regarding genetic algorithms. Burke et al. does not teach or suggest the

above-noted limitations of claim 1 regarding using a distribution of database records associated with a selected prediction algorithm, as recited in claim 1. Furthermore, Burke et al, does not teach or suggest the above-noted limitations of claim 14 regarding generations marked out and placed on a vulnerability list. Accordingly, Burke et al. does not remedy the defects in Lapointe et al., Arouh et al, and Boden as references against the invention defined in claims 18-20. Claims 18-20 therefore would not have been obvious from the cited references.

Examiner's response:

Buscema and Feldgajer are used as references in claim 1. The statement 'generations marked out and placed on a vulnerability list' is a classification in which 1 of the 4 laws would apply. A 'vulnerability list' could apply to either law 1 or law 2. Office Action stands.

11. In reference to the Applicant's argument:

Claims 26-29, dependent from claim 25 (and indirectly from claim 1), were rejected under 35 U.S.C. § 103(a) as being unpatentable over Lapointe et al. and Arouh et al. in view of either or both of Rase (U.S. Patent Application Publication No. 200210178132) and Breed (U.S. Patent Application Publication No. 2003/0002690). Rose is understood to disclose an adaptive signal recognition system using a reiterative algorithm. Breed is understood to disclose a system employing sensors and transducers for determining the status of a person inside a vehicle. Neither of these references discloses or suggests a method including distribution of database records, an evolutionary algorithm, or using a distribution of database records associated with a selected prediction algorithm in supervised learning, as recited in claim I . It follows that neither references discloses or suggests a system for carrying out this method, as recited in claim 25. Accordingly, neither Rose nor Breed remedies the above-noted defects of Lapointe et al. and Arouh et al. as references against the inventions defined in claims 26-29. Claims 26-29 therefore would not have been obvious from the cited references.

Examiner's response:

Buscema and Feldgajer are used as references in claim 1. Feldgajer discloses using genetic algorithms to modify neural networks. Buscema discloses the distribution of database records. Office Action stands.

12. In reference to the Applicant's argument:

Claims 30-34 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Lapointe et al. and Arouh et al. in view of Kwok et al. (U.S. Pat. No. 6,177,249). The applicant respectfully submits that claim 30 is patentable over the cited art, for the following reasons.

Claim 30 is directed to a method for producing a microarray for genotyping operations, including the steps of providing a database of experimentally determined data; dividing the database into a training and a testing dataset for training and testing a prediction algorithm; defining two or more different training datasets; training and testing the prediction algorithm with each of the different training sets and the associated testing set; calculating a fitness score or prediction accuracy of each algorithm; and providing an evolutionary algorithm. As discussed above, Lapointe et al. does not disclose or suggest calculating a fitness score or prediction accuracy, and does not provide an evolutionary algorithm as recited in claim 30. In addition, as discussed above, Arouh et al. does not suggest calculating a fitness score as required by the claim. Furthermore, Lapointe et al. does not provide the required motivation for combination with Arouh et al. to obtain a reference against the invention defined in claim 30.

Kwok et al. is understood to disclose a method of detecting a nucleotide or sequence of nucleotides; Kwok et al. does not disclose or suggest defining datasets, training and testing prediction algorithms, or providing an evolutionary algorithm. In particular, Kwok et aL does not suggest calculating a fitness score as recited in claim 30. Furthermore, Kwok et al. does not suggest repeatedly applying an evolutionary algorithm until a predetermined fitness score has been reached. It follows that Kwok et al. cannot remedy the above-noted defects of Lapointe et al. or Arouh et as a reference against the invention defined in claim 30. The features of claim 30 described just above would not have been obvious from either of the references, or from a combination of them.

Examiner's response:

Kwok is no longer used as a reference. Claims 30-35 are covered with Buscema and Feldgajer. Feldgajer discloses using genetic algorithms to modify neural networks. Buscema discloses the distribution of database records. Office Action stands.

Examination Considerations

13. The claims and only the claims form the metes and bounds of the invention. "Office personnel are to give the claims their broadest reasonable interpretation in light of the supporting disclosure. *In re Morris*, 127 F.3d 1048, 1054-55, 44USPQ2d 1023, 1027-28 (Fed. Cir. 1997). Limitations appearing in the specification but not recited in the claim are not read into the claim. *In re Prater*, 415 F.2d, 1393, 1404-05, 162 USPQ 541, 550-551 (CCPA 1969)" (MPEP p 2100-8, c 2, l 45-48; p 2100-9, c 1, l 1-4). The Examiner has the full latitude to interpret each claim in the broadest reasonable sense. Examiner will reference prior art using terminology familiar to one of ordinary skill in the art. Such an approach is broad in concept and can be either explicit or implicit in meaning.

14. Examiner's Notes are provided to assist the applicant to better understand the nature of the prior art, application of such prior art and, as appropriate, to further indicate other prior art that maybe applied in other office actions. Such comments are

entirely consistent with the intent and sprit of compact prosecution. However, and unless otherwise stated, the Examiner's Notes are not prior art but link to prior art that one of ordinary skill in the art would find inherently appropriate.

15. Examiner's Opinion: Paragraphs 13 and 14 apply. The Examiner has full latitude to interpret each claim in the broadest reasonable sense.

Conclusion

16. The prior art of record and not relied upon is considered pertinent to the applicant's disclosure.

-U. S. Patent 5706321: Chen

-U. S. Patent 5926773: Wagner

-' Evolving artificial neural networks': Xin Yao

-' Evolutionary algorithms with dynamic population size and local exploration for multiobjective optimization': Tan

-' Evolving pattern recognition systems': Rizki

-' Parallelism and evolutionary algorithms': Riff

-' Evolutionary approach to distribution network reconfiguration for energy saving': Song

-' An evolutionary algorithm that constructs recurrent neural networks': Foerreira

-' Using evolutionary computation to learn about detecting breast cancer': Fogel

-' Linear and neural models for classifying breast masses': Fogel

17. Claims 1-35 are rejected.

Correspondence Information

18. Any inquiry concerning this information or related to the subject disclosure should be directed to the Examiner Peter Coughlan, whose telephone number is (571) 272-5990. The Examiner can be reached on Monday through Friday from 7:15 a.m. to 3:45 p.m.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor David Vincent can be reached at (571) 272-3080. Any response to this office action should be mailed to:

Commissioner of Patents and Trademarks,

Washington, D. C. 20231;

Hand delivered to:

Receptionist,

Customer Service Window,

Randolph Building,

401 Dulany Street,

Alexandria, Virginia 22313,

(located on the first floor of the south side of the Randolph Building);

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(571) 272-3150 (for formal communications intended for entry.)

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Peter Coughlan

7/13/2007

7/18/07
DAVID VINCENT
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